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Remarks

Thorough examination by the Examiner is noted and appreciated.

The Specification has been amended to correct grammatical errors.

The claims have been amended to overcome Examiners objections and clarify Applicants disclosed invention.

Support for the amendments and newly drafted claims is found in the original claims and the Specification.

No new matter has been added.

For example, support for the amendments made in claim 1, are found in the original claims and in the Specification at paragraph 0021:

"Referring to Figure 1B, conventional photolithographic patterning and dry etching processes are then carried to form a dual damascene opening 18, for example exposing the underlying conductive area 11. For example a via opening 18A, is first formed by conventional photolithographic patterning and

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reactive ion etch (RIE) processes, preferably, but not exclusively formed having a diameter of less than about 0.25 microns, more preferably less than about 0.17 microns. In an important aspect of the invention, the trench opening portion 18B is etched by a conventional RIE etch process to stop on the composite SiON/SiC second etch stop layer 12B, preferably including etching through a thickness portion, preferably through the thickness of the uppermost layer, but not through the entire thickness of the second stop layer 12B."

Claim Rejections under 35 USC 103(a)

1. Claims 1, 6, 9-11, 13, 16, and 19-21 stand rejected under 35 USC Section 103(a) as being unpatentable over Nguyen (US 5,904,565) in view of Kim (US 6,436,303).

Nguyen discloses a method of forming a dual damascene in a dielectric insulating layer without a middle etch stop layer (see Abstract; Figures 12-18). Nguyen discloses a trench first method of forming the dual damascene structure, where a trench portion is first formed (see Figure 12; col 9, lines 3-5)), followed by selectively (anisotropically) depositing a barrier layer on horizontal surfaces (see Figure 13; col 9, lines 16-26). A via portion is then formed through a remaining thickness of the dielectric insulating layer to form a dual damascene opening (see Figure 14; col 9, lines

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27-34). A second barrier layer is deposited conformally to line the dual damascene opening (see Figure 15, lines 35-44). An anisotropic etch process is then carried out to remove the second barrier layer over on overlying surfaces including the trench bottom surface and a conductive are under the via (see Figure 16, lines 46-55).

Thus Nguyen discloses a completely different process for forming a dual damascene compared to Applicants disclosed and claimed invention. For example, Nguyen discloses a trench first via formation process rather than a via first formation process of Applicants, such processes working by different principles and different processing steps.

For example Nguyen does not disclose several aspects of Applicants disclosed and claimed invention including:

Nguyen does not disclose:

"providing a substrate comprising upper and lower dielectric insulating layers separated by a middle etch stop layer comprising multiple layers;"

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Nguyen does not disclose:

"forming a dual damascene opening by first forming a via extending through a thickness of the upper and lower dielectric insulating layers;"

Nguyen does not disclose:

then forming an upper trench line portion extending through the upper dielectric insulating layer thickness and partially through the middle etch stop layer thickness including an uppermost layer comprising the middle etch stop layer;

Nguyen therefore, also does not disclose:

"blanket depositing a barrier layer comprising at least one of a refractory metal and refractory metal nitride to line the dual damascene opening;

"removing a bottom portion of the barrier layer to reveal an underlying conductive

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area;"

Nguyen teaches away from Applicants disclosed and claimed invention by teaching a **trench first via formation process**.

The process of Nguyen could not accomplish the following aspect of Applicants claimed invention since the method of Nguyen works by a different principle of operation.

"then forming an upper trench line portion extending through the upper dielectric insulating layer thickness and partially through the middle etch stop layer thickness including an uppermost layer comprising the middle etch stop layer;"

On the other hand, Kim teaches a remote plasma etching process to etch away undesired portions of dielectric films on a substrate including selectively removing films from peripheral surfaces (sidewall surface) while shielding major surfaces (horizontal surface) (see Abstract, col 1, lines 55-62), thereby teaching away from Applicants disclosed and claimed invention.

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Even assuming *arguendo* a proper motivation for combining the teachings of Nguyen and Kim, such combination does not produce Applicants disclosed and claimed invention.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

"A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997).

"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc.*, 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983), *cert denied*, 469 U.S. 851 (1984).

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2. Claims 2, 7, 12, 17, and 22 stand rejected under 35 USC Section 103(a) as being unpatentable over Nguyen in view of Kim, as applied to claims 1 and 13, above, and further in view of Ngo (US 6,525,428)..

Applicants reiterate the comments made above with respect to Nguyen and Kim.

Applicants also reiterate that Nguyen does not disclose or suggest a middle etch stop layer, but rather teaches away therefrom by teaching a trench first process without a middle etch stop layer (see col 3, lines 37-42). For example, the structure of Nguyen would not accomplish its intended purpose by having a middle etch stop layer as well as the first and second barrier layers of Nguyen.

Ngo, on the other hand discloses a dual damascene process including a graded middle etch stop layer formed of SiC/Si/SiC (see Abstract; col3, lines 1-6). Ngo also teach forming a barrier layer (item 30, Figure 3) including covering a bottom via portion, followed by a seed layer (item 31, Figure 3), followed by depositing a copper filling by electrodeposition (see col 6, lines 13-17).

There is no apparent motivation other than Applicants disclosure for combining

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the teachings of Nguyen and Ngo. As pointed out, the method of Nguyen is specifically aimed at producing a dual damascene without a middle etch stop layer. In addition, there is no suggestion or teaching in Ngo of using trench first dual damascene formation process or the selective deposition and removal of barrier layers, including a via bottom portion as taught in Nguyen. The methods of Nguyen and Ngo work by a different principle of operation. Any attempt to modify the teachings of Ngo or Nguyen to recreate Applicants disclosed and claimed invention would make the disclosed structures and methods of Nguyen and Ngo unsuitable for their intended purpose.

Nevertheless, even assuming *arguendo*, a proper motivation for combination, the combined teachings of Nguyen, Kim, and Ngo do not produce Applicants disclosed and claimed invention.

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).

"If proposed modification would render the prior art invention being modified

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unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

3. Claim 3 stands rejected under 35 USC Section 103(a) as being unpatentable over Nguyen in view of Kim, as applied to claim 1, above, and further in view of Smith (US 6,642,141).

The fact that Smith discloses the use of a graded silicon oxynitride film on a silicon nitride film on a **bottom etch stop** layer (over a conductive portion) does not help Examiner further in establishing a prima facie case of obviousness with respect to Applicants disclosed and claimed invention. For example, in the trench first (form trench first, then the via) process of Smith (see col 5, lines 9-14), Smith **does not** disclose or suggest the use of a **middle etch stop layer**, contrary to Examiners assertion, and such a middle etch stop layer would likely not be desirable or useful in the trench first dual damascene formation process of Smith. The methods of both Nguyen and Smith operate by a different principal of operation than Applicants disclosed and claimed invention. Any modification of Nguyen or Smith to achieve Applicants disclosed and claimed invention would change the principal of operation of

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both Nguyen and Smith.

Thus, even assuming *arguendo*, a proper motivation for combining the teachings of Nguyen, who also teaches a trench first formation process without a middle etch stop layer, such combination does not produce Applicants disclosed and claimed invention.

4. Claims 4, 5, 14, and 15 stand rejected under 35 USC Section 103(a) as being unpatentable over Nguyen in view of Kim, as applied to claims 1 and 13, above, and further in view of Wu (US Pub. 2005/0110153).

Applicants reiterate the statements made above with respect to Nguyen and Kim.

Applicants again note that nowhere do Nguyen or Kim et al. disclose or suggest **a middle etch stop layer**, contrary to Examiners assertion.

On the other hand, Wu discloses a **bottom etch stop layer** (formed over a metal area; see item 16, Figure 1) and **does not disclose a middle etch stop layer**, contrary to Examiners assertion, where the bottom etch stop layer is SiOC (paragraph 0027) or a composite of SiOC/and one or more of SiCN, SiCO, SiN, SiON, SiC, and SiO,

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preferably SiC/SiO (paragraphs 0030 and 0031).

Thus, even assuming *arguendo*, a proper motivation for combining the teachings of Wu with Nguyen and Kim, such combination does not produce Applicants disclosed and claimed invention.

5. Claims 8 and 18 stand rejected under 35 USC Section 103(a) as being unpatentable over Nguyen in view of Kim, as applied to claims 1 and 13, above, and further in view of Chooi (US 6,284,657).

The fact that Chooi teaches an ion metal plasma deposition process to deposit a barrier layer does not further help Examiner in establishing a *prima facie* case of obviousness with respect to Applicants disclosed and claimed invention.

"we do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination" *Symbol Technologies, Inc. v. Opticon, Inc.*, 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).

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Double Patenting

Claims 1, 6, 9-13, 16 and 19-22 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 10, and 12 of Tsai (US 6,878,615) in view of Kim (US 6, 436, 303).

Applicants respectfully point out that under a non-statutory obviousness type rejection, the disclosure of Tsai **is not to be used as prior art**, and a double patenting situation arises only where the **same subject matter is claimed** in Applicants patent and in Tsai. See MPEP Section 804 at page 800-22;

When considering whether the invention defined in a claim of an application is an obvious variation of the invention defined in the claim of a patent, **the disclosure of the patent may not be used as prior art.**

and at page 800-30;

A prior art reference that renders claimed subject matter obvious under 35 U.S.C. 102(e)/103(a) does not create a double patenting situation where that subject matter is not claimed in the reference patent. Where the subject matter that renders a claim obvious is **both claimed and disclosed** in a U.S. patent which satisfies the criteria of 35 U.S.C.

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102(e), the examiner should make rejections based both on double patenting and 35 U.S.C. 103(a). For applications filed on or after November 29, 1999, rejections under 35 U.S.C. 102(e)/103(a) should not be made or maintained if the applicant provides evidence that the subject matter of the reference and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Applicants respectfully point out that the **same subject matter** as Applicants claimed invention **is not** claimed or disclosed in Tsai. It is clear that the process of Applicants claimed invention including claim 1, includes elements which are neither claims nor disclosed in Tsai.

Tsai discloses and claims in claim 1, a process where a low-K protection lining is formed over the via following formation of a via in a via-first dual damascene formation process (see e.g., col 6, lines 30-35), forming a trench portion over the via, removing a portion of the low-K protection lining at the bottom of the via opening including a passivation layer, and then forming a barrier layer over the low-K protection layer to line the dual damascene opening (see claim 1).

Tsai neither claims not discloses "then forming an upper trench line portion extending through the upper dielectric insulating layer thickness and partially through the middle etch stop layer;"

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Applicants do not claim or disclose a low-K protection lining as in Tsai.

Kim does not disclose a dual damascene formation process, or formation of a barrier layer as pointed out above, and, further Kim teaches away from Applicants invention by teaching using a shield to shield a major (horizontal) surfaces while removing peripheral (sidewall surfaces) using a remote plasma etching process.

Thus, there is no apparent motivation in the claims of Tsai or the disclosure of Kim for combining the claims of Tsai with the teachings of Kim, other than Applicants disclosure and Applicants claims. Nevertheless, such combination does not produce Applicants claimed invention.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, **and not based on applicant's disclosure.**" *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

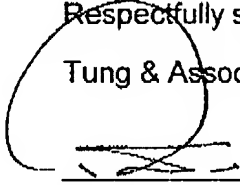
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Based on the foregoing, Applicants respectfully submit that Applicants Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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